

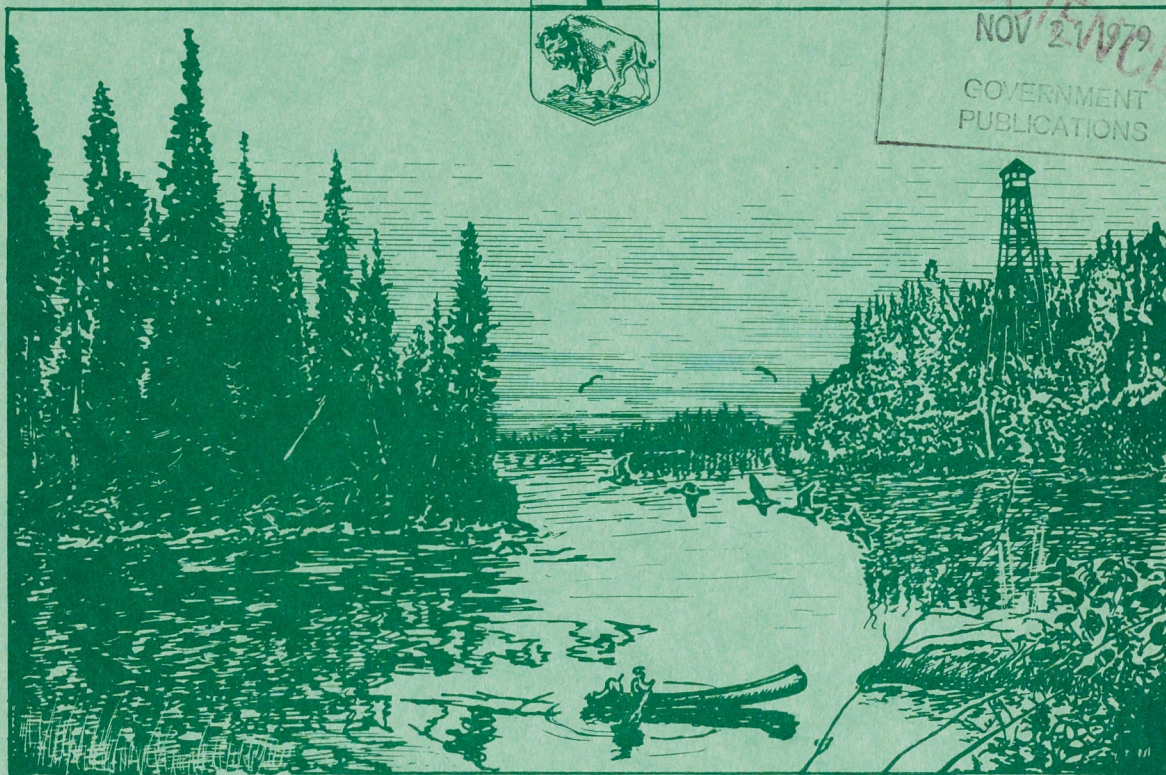
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Report No. 5

LOWLANDS NORTH FOREST SECTION



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GOVERNMENT
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Forest Resources Inventory

—1956—



FOREST SERVICE

Department of Mines and Natural Resources
PROVINCE OF MANITOBA

Winnipeg, 1959

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Forest Resources Inventory *1956*

Report No. 5

LOWLANDS NORTH FOREST SECTION



FOREST SERVICE
Department of Mines and Natural Resources
PROVINCE OF MANITOBA
Winnipeg, 1959



Forest Resources Inventory photograph showing country at southwest end of Simonhouse Lake.

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Preface

This is one of a series of bulletins summarizing the results of the ground and aerial survey work which was completed in 1956 in connection with the latest Forest Inventory of Manitoba. The figures in this new series will replace those previously used based on surveys made between 1927 and 1930, and tabulated in "The Forests of Manitoba, Bulletin 85," published by the Dominion Forest Service in 1934.

For the purpose of the new Forest Inventory the Province has been divided (as shown on Map 1) into four zones based on climate, original vegetation and predicted future use, as follows:

Agricultural Forest	Transition from Forest to Tundra Tundra or Barren Lands
------------------------	--

The Forest Zone may be defined as the area which is producing or is capable of producing forest crops and which for climatic reasons is, in the main, more suitable for the production of wood than for agricultural crops. The Forest Zone has an over-all area (omitting the three major lakes—Winnipeg, Manitoba and Winnipegosis) of about 113,238 square miles or nearly half the total area of Manitoba (less these lakes).

Based on the presence or absence of transportation routes such as railways, highways and water routes, the Forest Zone is again divided into an Accessible and Inaccessible Area.

The Accessible Forest Zone with an over-all area of about 64,122 square miles has been divided for Inventory purposes into seven main Forest Sections based on physical geography and administrative boundaries, as follows:

Southeastern	Lowlands North
Winnipeg River	Nelson River
Lowlands South	Northern Mining
Mountain	

Each of the Forest Sections is again divided into Working Circles which conform with Forest Ranger Districts, except in the more northerly areas where on account of their large size it has been necessary to subdivide the Ranger Districts. In addition to the seven major Forest Sections listed above, the Accessible Forest includes two minor areas in southern Manitoba—the Spruce Woods and the Turtle Mountain Forest Reserves.

The Inaccessible Forest with an over-all area of about 49,116 square miles has been divided into 20 Inventory Units.

Although a limited amount of the Forest Zone was inventoried before 1951, the main work was done commencing April 1st, 1951, from which date the Federal Government has reimbursed to the Province one-half of the expenditures incurred in forest resources inventory under the terms of an agreement with the Province pursuant to the provisions of the Canada Forestry Act.

A separate report will be published for each of the seven major Forest Sections of the Accessible Area, and an eighth report will cover the Spruce Woods and Turtle Mountain. The whole of the Inaccessible Forest will be covered by an additional report.

An explanation of the method of survey is given in the Appendix.

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PREPARED BY FOREST MANAGEMENT DIVISION

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Ground control and base mapping by Surveys and Mapping Branch, Department of Mines and Technical Surveys, Ottawa; and by Forest Service and Surveys Branch, Department of Mines and Natural Resources.

Field inventory, aerial photo interpretation, and forest maps by H. P. Laws and W. C. McLean, assisted by M. E. Benum, J. C. Chalmers, M. K. Lalor, J. D. McKellar, S. J. Williamson, and others.

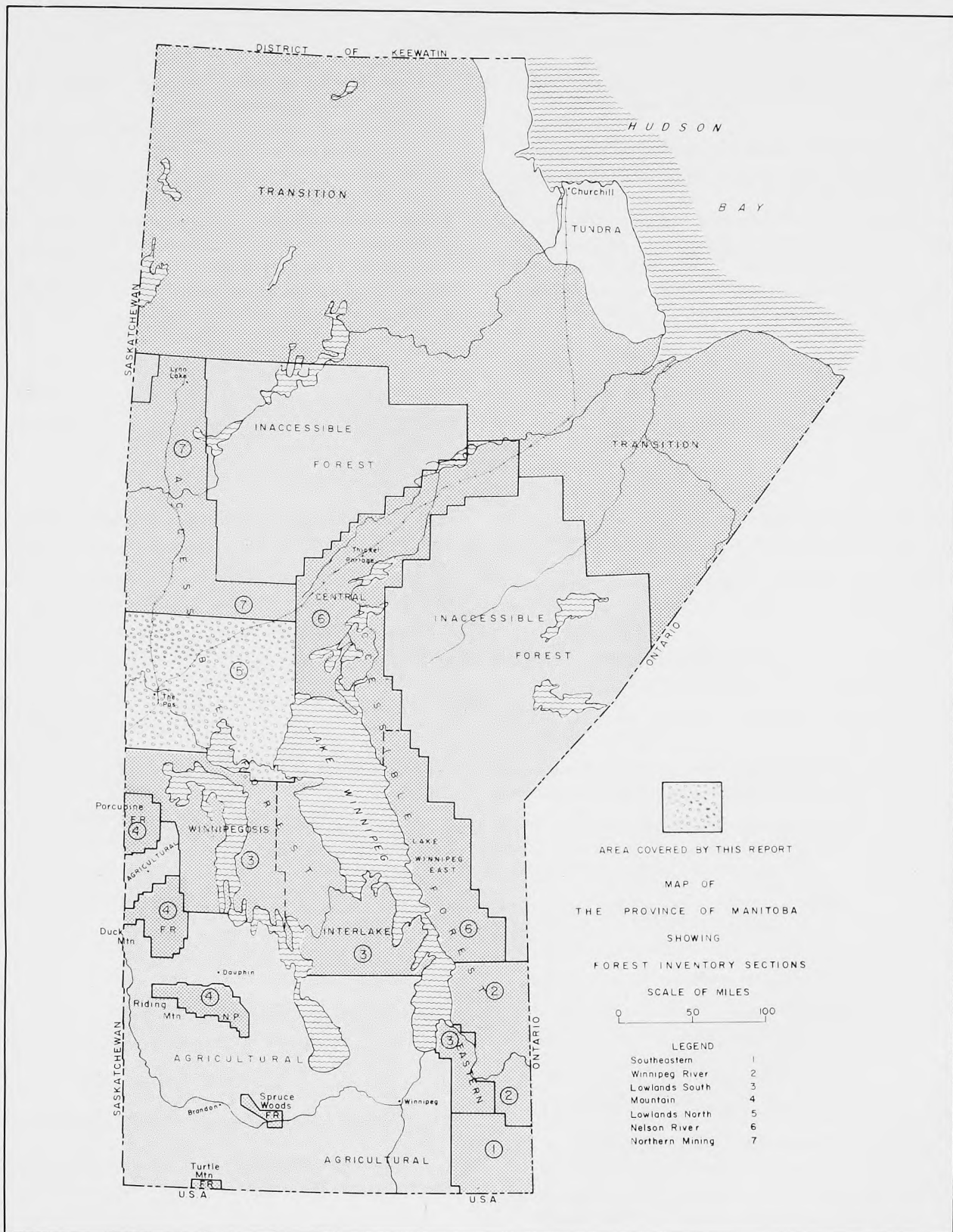
Tree volume tables by W. C. McLean.

General stand volume table, type aggregate volume tables, and final compilation by M. E. Benum, H. P. Laws, and W. C. McLean.

Maps Nos. 1 and 2 by P. Peloquin.

Tables Nos. 1 to 12 and figures 1 to 10 by L. Pasterz.

Cover design by D. R. McTavish.



Map No. 1



Limestone shore-line at Rocky Lake.

Forest Resources

LOWLANDS NORTH FOREST SECTION

Location and Area

The Lowlands North Forest Section consists of a more or less rectangular area in the general vicinity of The Pas. It is bounded on the west by the Saskatchewan boundary, on the north by the Northern Mining, on the east by the Nelson River (and Lake Winnipeg), and on the south by the Lowlands South Forest Section—see Map No. 1. The Forest Section extends for 115 miles in an east and west direction, while the distance from north to south varies from 90 to 108 miles.

Table 1
*Area Classification in Acres—Lowlands
North Forest Section*

Class of Area	Crown land	Patented land	Total area	% of land area
PRODUCTIVE FOREST LAND*	2,253,063	10,227	2,263,290	41.4
POTENTIALLY PRODUCTIVE FOREST				
LAND†	64,787	1,445	66,232	1.2
Clear cut.....	5,040	.....	5,040	.1
Burn.....	57,831	1,445	59,276	1.1
Shrub.....	1,916	.....	1,916	.....
NONPRODUCTIVE FOREST LAND‡	1,265,601	2,871	1,268,472	23.2
Treed muskeg.....	1,183,321	2,719	1,186,040	21.7
Willow and Alder.....	65,297	152	65,449	1.2
Treed rock.....	16,983	.....	16,983	.3
NONFORESTED LAND§	1,856,439	15,308	1,871,747	34.2
Farm field.....	48,417	10,427	58,844	1.1
Barren rock.....	3,330	.....	3,330	.....
Marsh.....	978,544	4,057	982,601	18.0
Muskeg.....	819,239	416	819,655	15.0
Unclassified.....	6,909	408	7,317	.1
TOTAL LAND	5,439,890	29,851	5,469,741	100.0
WATER	1,413,773	.....	1,413,773	25.8
TOTAL AREA	6,853,663	29,851	6,883,514	.....

*Land supporting merchantable timber or young growth which will produce merchantable timber within a reasonable time.

†Land not now supporting productive forest, but capable of doing so.

‡Land with a forest cover but incapable of producing a forest crop of merchantable size within a reasonable time.

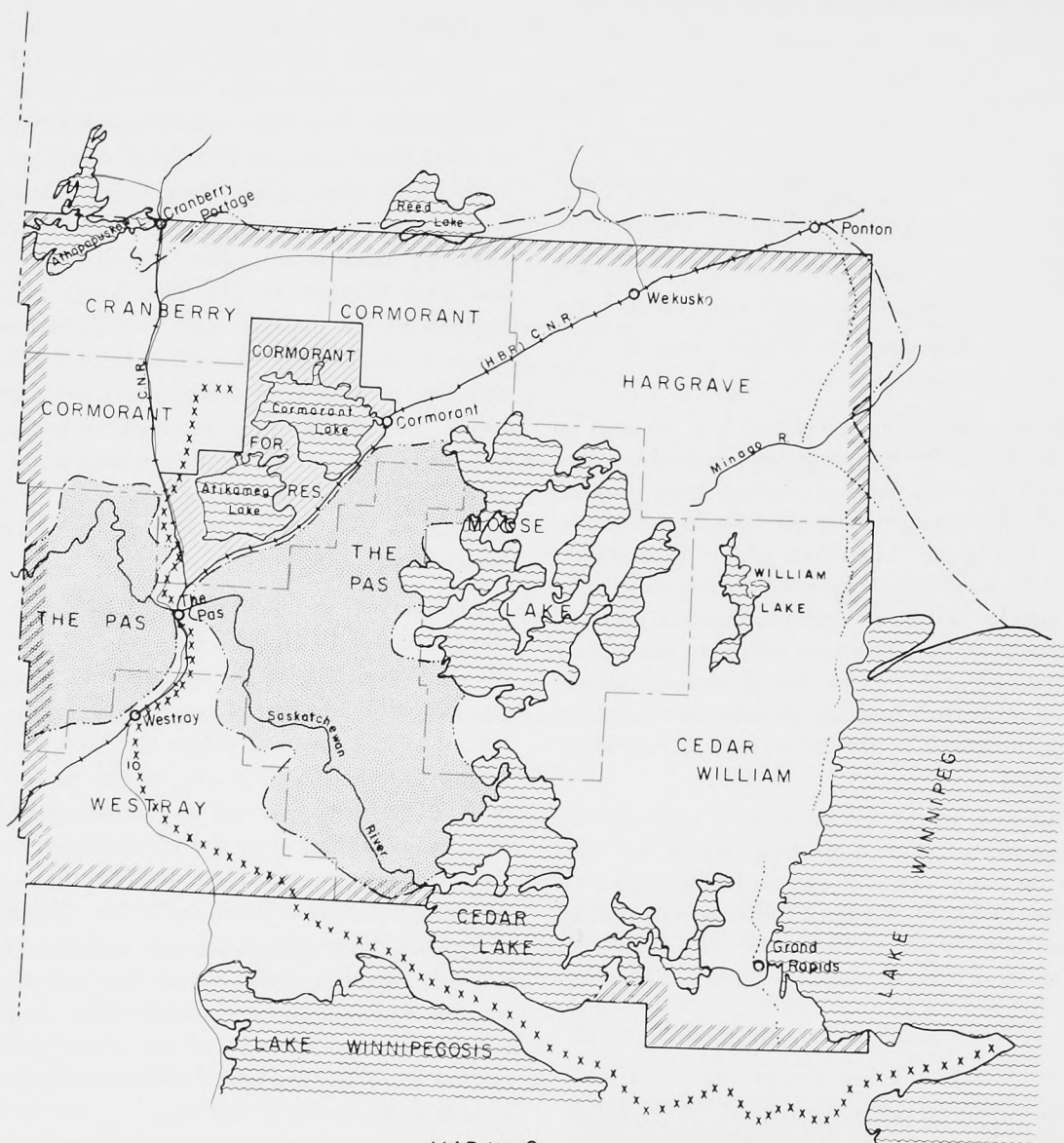
§In general, lands not expected to produce forest of any kind.

The total area covered by this report and estimate is 6,853,514 acres. This area excludes Indian Reserves but includes all other Crown and patented land and water areas. The patented land area is at present very small being confined mainly to the flood plain of the Saskatchewan River, and a small area near Wanless. For Inventory purposes the area has been divided into seven Working Circles—Westray, The Pas, Cedar-William, Moose Lake, Hargrave, Cormorant, and Cranberry, as indicated on Map No. 2.

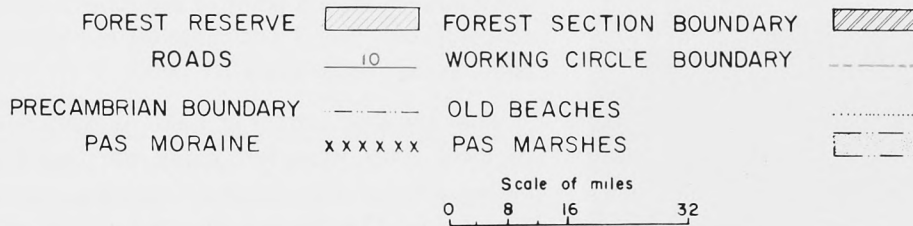
Geology

The underlying rock of this district consists of flat-lying limestone laid down in ocean water on the margin of an ancient Precambrian continent. The rock formations of the area are similar to those found in the Lowlands South—Ordovician in contact with the Precambrian, followed by Silurian and Devonian to the south and west. Uplift of the land, or sinking of the ocean, resulted eventually in the limestone beds becoming dry land.

The surface rock was exposed to normal erosion for a very long period of time, but no faulting or folding occurred, so that the rocks in general lie fairly flat, but with a slight dip to the southwest. One of the effects of erosion was the formation of a series of low escarpments with the steep sides to the north and east, caused by the differential erosion of hard and soft layers. The most conspicuous of these escarpments is one facing onto the Precambrian where the Ordovician limestone, at certain points, terminates in a steep cliff, 20 to 40 feet high; this escarpment may be seen at Reed Lake, Lake Athapapuskow and many other points. Silurian rocks are exposed at Grand Rapids on the Saskatchewan, at Cedar, Moose, Atikameg Lakes and elsewhere. Devonian rocks are not exposed but from information recorded for adjoining areas it is assumed that the surface deposits along the Canadian National Railway between Whithorn and Turnberry are underlain by this system.



MAP No.2
LOWLANDS NORTH FOREST SECTION



Map No. 2

Table 2

Classification of Productive Forest Land By Cover Types and Tenure—Lowlands North Forest Section

COVER TYPE	Crown land		Patented land		Total land	
	acres	%	acres	%	acres	%
S: Over 75% softwood.....	1,540,737	68.4	4,882	47.7	1,545,619	68.3
M: 50 - 75% softwood.....	584,521	25.9	1,096	10.7	585,617	25.9
N: 25 - 50% softwood.....	61,603	2.8	4,092	40.0	65,695	2.9
H: Under 25% softwood.....	66,202	2.9	157	1.6	66,359	2.9
TOTAL.....	2,253,063	100.0	10,227	100.0	2,263,290	100.0

During the glacial age the region was covered to a great thickness by the series of continental glaciers which covered most of the northern part of the North American continent. Geologists have evidence that there were four major glaciations, separated by inter-glacial periods during which the climate was as warm, or warmer, than at present. Drift deposits of the earlier ice advances have been obliterated or buried by the last glaciation, named Wisconsin, so that the surface geology of the region is largely the result of the advance and retreat of this ice-sheet.

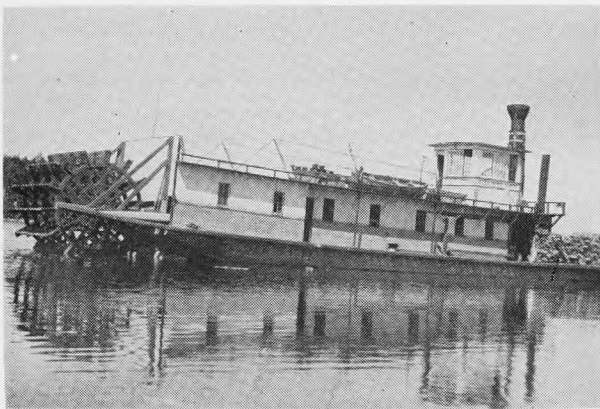
The direction of the ice advance is indicated by grooved markings, known as striae, which are conspicuous on many areas of exposed limestone rock of the region. These markings indicate that during Wisconsin time the ice advanced, first from the north, and later from the east, as there are two sets

of striations; the latter being from the east and over-riding the earlier markings.

At one stage in the retreat of the glacier, the ice front remained stationary for a long period leaving a very well marked ridge, commonly known as The Pas moraine. This ridge is continuous from the end of Long Point on Lake Winnipeg, westward, where it divides Cedar Lake from Lake Winnipegosis, with elevations up to 90 feet. No. 10 Highway follows the moraine from the "Big Bog" to Westray, and from Westray to The Pas. North of the Saskatchewan, the moraine may be followed as a pronounced ridge along the east side of Reader Lake and the west side of Atikameg and Cormorant Lakes. This northern extension of the moraine may have been formed at the line where the northern, or Keewatin, lobe of the ice-sheet met the eastern, or Patricia, lobe, and hence may be described as interlobate.

The normal drainage of the Saskatchewan and Nelson Rivers to Hudson Bay was blocked by the ice-sheet, resulting in the formation of glacial Lake Agassiz, which, when it reached a certain height, spilled at first southward into the Mississippi, later to the eastward, and finally to the northward, as new outlets were exposed by the retreat of the ice. It is probable that after the ice retreated from The Pas moraine it still remained to the eastward, blocking the Nelson River outlet for some considerable time. During this interval a series of strand lines, or terraces, about seven in all, were formed on the steep south and west sides of The Pas ridge, as a result of wave action by the glacial lake. As the ice retreated still further to the eastward, lowering the level of the lake, a pair of beaches were laid down on the western shore. These beaches, which have been named Grand Rapids, run in a north and south direction, more or less continuously from a point of the same name on the Saskatchewan River to Ponton on the Hudson Bay Railway—see Map No. 2.

After the final retreat of Lake Agassiz, a number of local lakes were left along the Saskatchewan valley. One of these appears to have covered the area below The Pas moraine and was in effect an enlarged Moose Lake, while a second lake occupied the present marsh area west of The Pas.



Stern wheel steamer, formerly used on the Saskatchewan River.

LAND and WATER AREA by OWNERSHIP

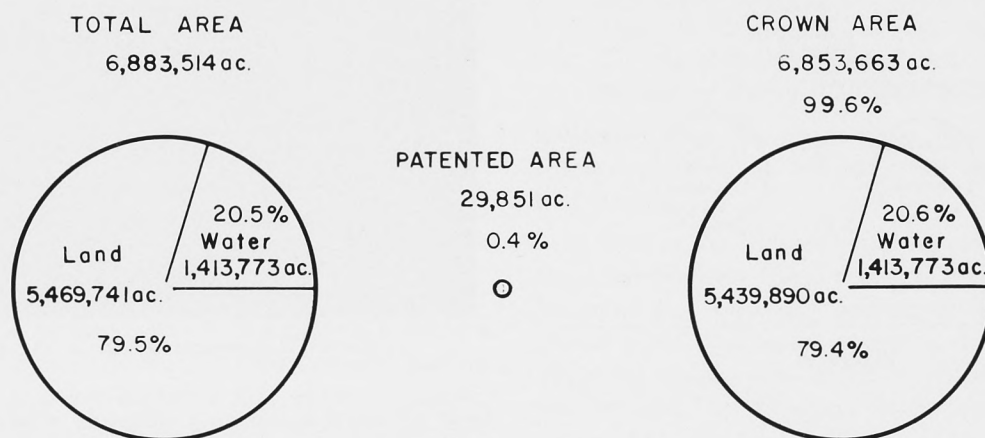


Figure 1.

Topography

The Lowlands North Forest Section is fairly level; the most noteworthy differences in elevation being due to the limestone escarpment at the Precambrian contact and to The Pas moraine, both of which have been described above. The highest recorded elevation is 1,039 feet above sea level at a point west of Lake Athapapuskow, while Lake Winnipeg with an elevation of 713 feet is the lowest.

Most of the area is drained by the Saskatchewan River and its tributaries; the Goose and Sturgeon-weir system draining Athapapuskow, Goose, Egg, and Namew Lakes, and the Cowan River - Frog Creek-Summerberry River system, draining Pothier, Yawningstone, Atikameg, Cormorant and Moose Lakes. Cedar Lake is a conspicuous enlargement of the Saskatchewan River. A small area in the north-west drains into Cross Lake (Nelson River) by way of the Minago and its tributary, the Hargrave

River; while fringes along the north, including Simonhouse Lake and the Mitishto River, drain by way of the Grass River, to the Nelson. William Lake drains by way of a river of the same name directly into Lake Winnipeg.

Nearly 2,000 square miles of this Forest Section is taken up by the flood plain of the Saskatchewan River, locally called—The Pas Marshes—see Map No. 2. The river drops only 20 feet between the provincial boundary and the lower end of Cedar Lake in a distance of 102 miles, as the crow flies. This is a sharp contrast with the drop of 117 feet between Cedar Lake and Lake Winnipeg, a distance of 14 miles. The whole area of the marshes is a maze of waterways and shallow lakes, best illustrated by a view from the air—see aerial photograph on page 20. Natural levees occur along the main river and along its numerous subsidiary channels, with lakes and marshes occupying the lower ground between the various waterways.

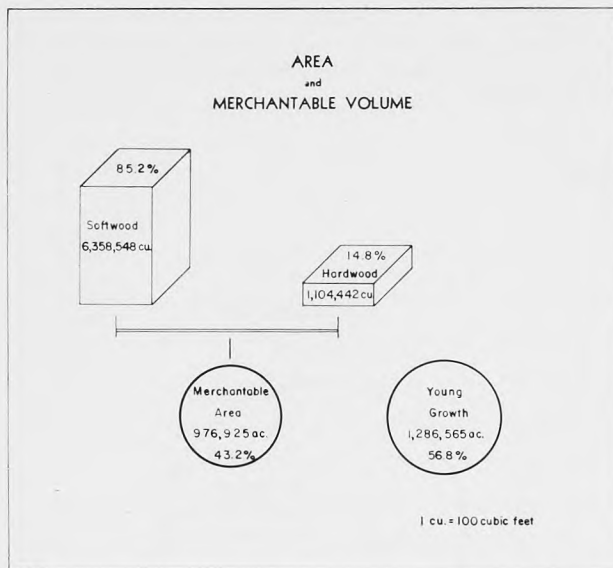
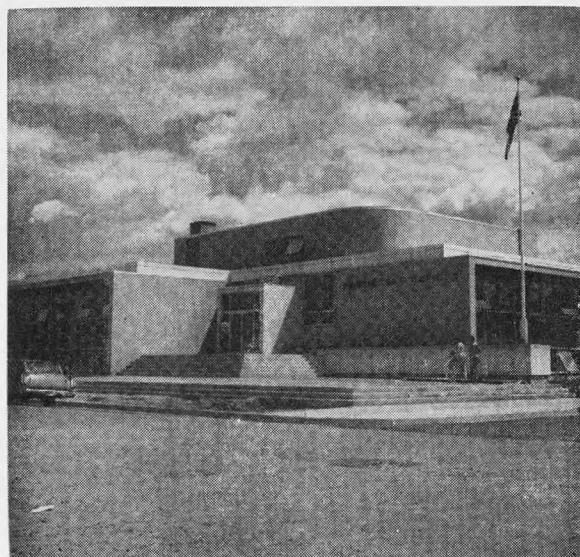


Figure 2.



Provincial Government offices at the Pas.

Soils

Generally speaking, the normally drained soils of the Lowlands North Forest Section belong to the grey-wooded great soil group. Such soils are developed under somewhat moist conditions and under the influence of a forest cover.

The parent soil material over most of the area is boulder till mainly derived from the underlying limestone, and consequently the soils are high in lime, except where they have been modified by the influence of vegetation or by the super-imposition of deposits of lacustrine or fluvial material. The till soils, where they form the surface vary considerably in depth, but there is usually enough soil to support satisfactory forest growth.

Considerable areas occur of deep soil laid down by sedimentation in former lakes, or by the flooding of former or existing rivers, and these soils are generally of high quality when drainage is adequate. Soils of this nature which are prevalent in the area south of Simonhouse Lake and between Atik and the Saskatchewan boundary support some of the best stands of timber in the Forest Section.

Deltaic deposits ranging from clay, through silty clay, to silt, and very fine sand, are mainly confined to the Saskatchewan River marsh area, where they may have considerable depth. Soil surveys have shown that the coarser materials are more apt to be found in the natural levees which have been

built up along the stream channels, while the finer textured materials are commonly found in the sedimentation basins between the channels.

Where drainage is inadequate, peat soils are prevalent and some of these, where the peat cover is not too deep, support satisfactory stands of black spruce pulpwood. However, there are, due to lack of drainage, large areas of peat soils where tree growth is either lacking, or if present, is too stagnated to be classed as productive forest.

Climate and Natural Vegetation

Weather observations have been recorded at The Pas and vicinity for about forty-five years, while records have been kept at Grand Rapids for a shorter period. The Pas records show an average annual precipitation of 16.90 inches. July is the rainiest month with 2.56 inches, followed by June with 2.36 and August with 2.31 inches.

The average mean daily maximum temperature for July at The Pas is 75 degrees above and the mean daily minimum for January is 18 degrees below zero. The average length of the period free from killing frost, taken as 29.5° is 119 days, and the frost free period, using 32°, is 110 days.

The Lowlands North Forest Section corresponds approximately with the northern portion of the Manitoba Lowlands Section, B-15, as mapped in "A Forest Classification for Canada." The forest

cover in the whole of the Manitoba Lowland is very similar, being characterized by white spruce, aspen, and birch on the normally drained sites; black spruce and tamarack on the poorly drained sites. Pure stands of jack pine and poplar have taken over considerable areas temporarily, as a result of forest fires. Balsam fir is a minor component of the older white spruce and white spruce-aspen stands. Balsam poplar may replace aspen in whole or part in those stands where moisture conditions are slightly above average.

As an example of what trees can do in this Forest Section on the best sites, sound white spruce has been cut which had diameters of 40 inches measured at breast height and heights of 115 feet.

Three tree species which reach their northern limit on the banks of the Saskatchewan River are white elm, green ash, and Manitoba maple. Among the shrubs it seems probable that mountain maple, hawthorn, beaked hazel, ground cherry, and possibly choke cherry reach their limit in the vicinity of the Saskatchewan River or at least within the Forest Section.

History

When white fur traders first came into the region, the inhabitants seem to have been Crees, although Henry Kelsey on his journey inland from York Factory in 1690-91 also came in contact with Assiniboines and Gros Ventres. The white men were

interested in the country as a source of furs, especially beaver, and exploration was undertaken mainly to find new beaver country, and to establish friendly relations with Indians who could trap and barter the furs for European goods. Henry Kelsey in his quaint rhymed version of his journey says:

*"The ground begins to be dry with wood
Poplo & birch with ash that's very good
For the Natives of that place wch knows
No use of Better than their wooden Bows."*

indicating that he must have reached the Saskatchewan River as ash does not occur north of that stream.

As long as the Indians could be induced to bring their furs to the trading posts on Hudson Bay, the Hudson's Bay Company had no cause to establish inland posts, but as competition developed from Montreal traders the situation changed. La Verendrye built Fort Bourbon on or near Cedar Lake about 1742, and Fort Paskoyac at The Pas in 1749. A few years after the end of the French regime in Canada in 1763, independent traders from Montreal had reached the Saskatchewan River. The Hudson's Bay Company countered this competition for some time by sending traders inland to contact the Indians and bring them to York Factory, and this proving insufficient, established Cumberland House on the Saskatchewan River in 1774. By 1787 the Northwest Company had been formed by the amalgamation of all the Montreal traders, and from

Table 3

*Area Classification of Productive Forest by Age Classes, Cover Types and Merchantability
Lowlands North Forest Section*

AGE CLASS <i>years</i>	COVER TYPES IN ACRES									
	S		M		N		H		Total	
	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.
0 - 20.....	291,525		317,117				32,649		641,291	
21 - 40.....	515,291	156,269	83,166	18,897		10,813	2,280	14,866	600,737	200,845
41 - 60.....	43,364	250,372	144	48,195		14,933		7,155	43,508	320,655
61 - 80.....	1,029	154,732		64,595		17,475		6,968	1,029	243,770
81 - 100.....		113,770		45,145		19,361		2,441		180,717
100 - over.....		19,267		8,358		3,113				30,738
SUBTOTAL.....	851,209	694,410	400,427	185,190		65,695	34,929	31,430	1,286,565	976,725
TOTAL.....	1,545,619		585,617		65,695		66,359		2,263,290	

Patented lands amount to $\frac{1}{2}$ of 1% of Productive Forest Area, balance Crown Lands.

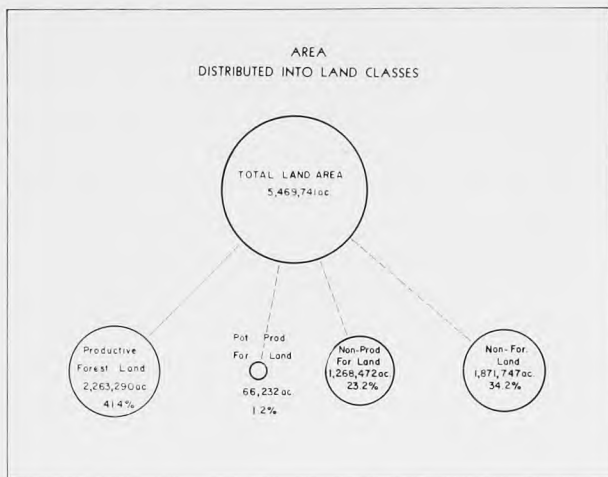


Figure 3.

then on competition with Hudson's Bay Company was intense, until 1821, when the two companies were amalgamated.

Water routes were all important in the early days, and the Saskatchewan River was one of the main routes, connecting as it did both Hudson Bay and Montreal with the western plains, the Rocky Mountains, and the Athabasca country, so that an

energetic fur trader located on the lower Saskatchewan might divert the Indian canoes with their furs, intended for his rival, to his own company. The climax of this struggle for the control of the fur trade came in 1819 when Governor Williams of the Hudson's Bay Company intercepted the eastbound Athabasca brigade of the Northwest Company, bound for Montreal, at Grand Rapids, seized the furs, and sent the partners under arrest to York Factory. Two years later, in 1821, the two companies found it advantageous to unite under the name of the older company. The Hudson's Bay Company remained in undisputed possession of the region until the surrender of their charter to the new Dominion of Canada in 1870.

In addition to the main Saskatchewan River canoe route, there were several other routes through or near the Lowlands North Forest Section which were of importance to the fur trade and later to other development. One of these routes connected the Saskatchewan River to the Nelson by way of Moose Lake and the Minago River; another was the route from the Saskatchewan by the Goose River which connected with the Grass River system at Cranberry Portage; while further west was the Sturgeon-weir route which connected the Sas-



Forestry office and Lookout tower at the entrance to Cormorant Forest Reserve.

Table 4

*Softwood and Hardwood Volume By Age Classes and Cover Types—
Lowlands North Forest Section*

AGE CLASS years	VOLUME IN CUNITS BY COVER TYPE (1 Cunit equals 100 cu. ft. of wood)											
	S			M			N			H		
	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total	Softwood	Hardwood	Total
0 - 20.....	590,518	116,181	706,699	75,458	17,274	92,732	37,334	27,242	64,576	19,797	45,201	64,998
21 - 40.....	1,341,738	143,561	1,485,299	270,740	53,806	324,546	47,194	35,027	82,221	14,107	30,962	45,069
41 - 60.....	1,123,189	102,019	1,225,208	460,287	93,559	553,846	74,385	53,241	127,626	11,404	27,965	39,369
61 - 80.....	1,345,814	92,379	1,338,193	482,129	102,886	585,015	114,484	90,936	205,420	6,199	15,357	21,556
81 - 100.....	314,818	21,123	335,941	105,461	19,591	125,052	23,492	16,132	39,624	.....	.....	.....
101 - over.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	443,771	56,846	500,617
TOTAL.....	4,616,077	475,263	5,091,340	1,394,075	287,116	1,681,191	296,889	222,578	519,467	51,507	119,485	170,992
										6,358,548	1,104,442	7,462,990

*Net roundwood volume: stump height 1', top diameter 3"; one stacked cord equals approximately 85 cu. ft. of wood.

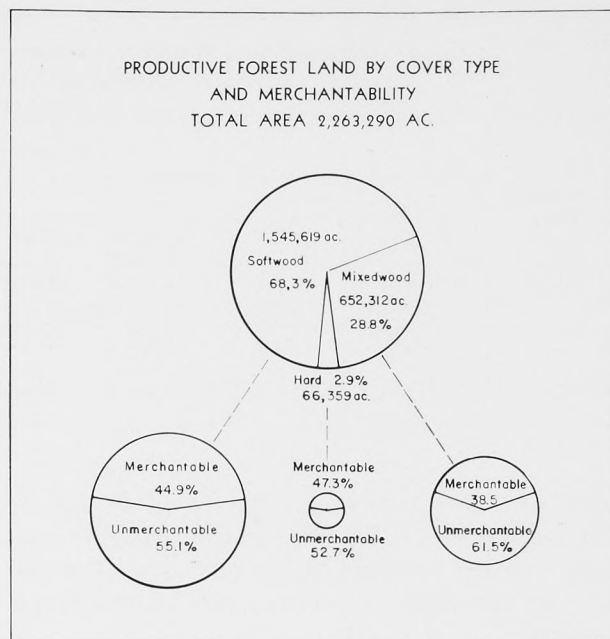


Figure 4.

katchewan River to the upper Churchill and the Athabasca country.

Development of the Area

The surrender of Rupertsland to Canada in 1870 resulted in an influx of settlers into the western territories and the development of steamboat navigation on Lake Winnipeg and the Saskatchewan River. Steamers from the Red River came only as far as the foot of Grand Rapids, while other steamers operated above the rapids, whence some of them proceeded west as far as Edmonton on the north branch and Medicine Hat on the south branch of the Saskatchewan.

Lumbering on a large scale had to wait until the Canadian Northern Railway reached The Pas in 1910 when the Finger Lumber Company (later, The Pas Lumber Company) commenced sawmill operations at that place. This mill operated yearly until 1958 producing as much as 50,000,000 ft. board measure in a peak year. Most of the timber originated in the province of Saskatchewan and was floated down the Sipanok Channel and the Carrot River to the main Saskatchewan River which it joined a few miles above The Pas. In later years, Manitoba logs cut on Moose Lake were hauled by

Table 5
*Softwood and Hardwood Volume by Cover Types and Size Classes—
 Lowlands North Forest Section*

COVER TYPE	VOLUME IN CUNITS (100 cu. ft. Units)								
	Softwood			Hardwood			Total		
	4" - 9"	10" +	Total	4" - 9"	10" +	Total	4" - 9"	10" +	Total
S.....	3,826,211	789,866	4,616,077	420,491	54,772	475,263	4,246,702	844,638	5,091,340
M.....	1,052,319	341,756	1,394,075	237,416	49,700	287,116	1,289,735	391,456	1,681,191
N.....	206,451	90,438	296,889	178,708	43,870	222,578	385,159	134,308	519,467
H.....	44,214	7,293	51,507	103,687	15,798	119,485	147,901	23,091	170,992
TOTAL.....	5,129,195	1,229,353	6,358,548	940,302	164,140	1,104,442	6,069,497	1,393,493	7,462,990

truck over iced roads for distances of 45 and 60 miles to the mill at The Pas. Smaller portable saw-mills were operated before the railway arrived and are still operating in various parts of the Forest Section.

There has been considerable spruce pulpwood output since about 1938 and the district has been a leading producer of jack pine railway ties for the last 30 years.

The first fur rehabilitation block in Manitoba was developed in the Summerberry block, east of The Pas, starting in 1936. By the control of water levels in the marshes it was found that muskrats in the area increased in three years from 5,000 to 200,000. Registered trap lines cover the balance of the Forest Section. In addition to muskrat—mink, weasel, beaver, squirrel, otter, lynx, and fisher are the principal fur bearers. Ducks and geese are plentiful and large numbers nest in the area. Sharp-tail grouse, partridge, and ptarmigan are also found. Moose and deer are found throughout the area with a few pockets of woodland caribou.

Commercial fishing operations have developed in most of the larger lakes of the area, but certain lakes near the highway have been reserved for sports fishing which yearly draws increasing numbers of tourists to the area.

Recreational areas have been developed at Atikameg, Cormorant, Rocky, Simonhouse and Athapapuskow Lakes. The green-tinged waters and white limestone rock exposures on the shorelines have given the lakes in this Forest Section a distinctive character which sets them apart from other

lakes in the surrounding areas. The Cormorant Forest Reserve which is an important recreational area, with an area of 575 square miles, was established in 1947.

Agricultural development has been mainly confined to the flood plain of the Saskatchewan above The Pas. A small settlement along the Carrot River was started during the First World War and during the dry 1930's other settlers were attracted from southern Manitoba, this movement being stimulated by the opening of No. 10 Highway to The Pas in 1939, and the establishment of important mining industries further north. Settlement was hampered by periodic flooding and inadequate drainage and it was realized that agriculture could not be safely expanded until these handicaps were overcome. In 1953, a plan for dyking and draining an area of about 120,000 acres, known as the Pasquia Project, was approved by the Federal and



*Euclid truck hauling train of log-sleighs on iced road
 from Moose Lake to The Pas.*

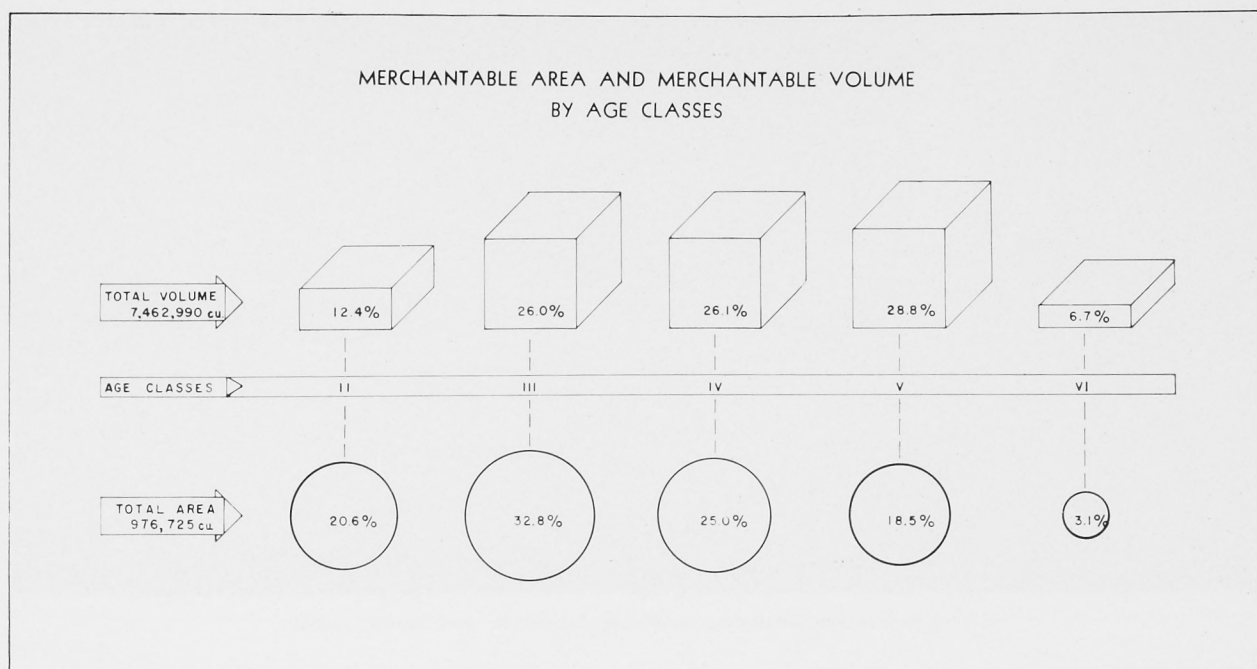


Figure 5.

Provincial Governments. The main dykes and most of the major drains have been constructed as well as many of the minor drains and roads, and it is anticipated that the full development will be com-

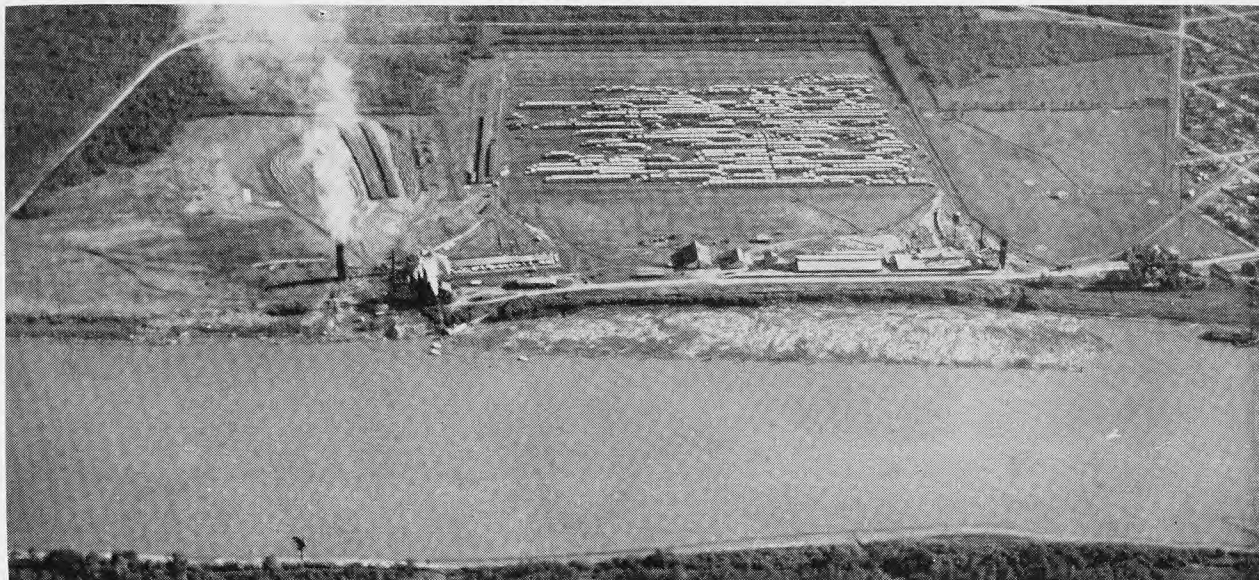
pleted by 1960. Limited agricultural development has also taken place on higher land near Wanless where the main success has been in the production of alfalfa seed on narrow strips cut through the

Table 6
*Softwood and Hardwood Volume by Species and Size Classes—
Lowlands North Forest Section*

SPECIES	*CUNITS BY DIAMETER CLASSES						†SAW TIMBER
	Total		4' - 9" D.B.H.		10" + D.B.H.		10" and Over
	volume	per cent	volume	per cent	volume	per cent	M ft. b.m.
White spruce.....	2,119,110	28.4	1,304,572	21.5	814,538	58.5	366,542
Black spruce.....	1,806,115	24.2	1,687,392	27.8	118,723	8.5	53,425
Balsam fir.....	83,575	1.1	73,598	1.2	9,977	.7	4,490
Jack pine.....	2,340,671	31.4	2,054,605	33.9	286,066	20.5	128,730
Tamarack.....	9,077	.1	9,028	.1	49	.....	22
TOTAL SOFTWOOD.....	6,358,548	85.2	5,129,195	84.5	1,229,353	88.2	553,209
Aspen.....	677,570	9.1	567,804	9.4	109,766	7.9	49,395
Balsam poplar.....	290,428	3.9	243,559	4.0	46,869	3.4	21,091
White birch.....	136,444	1.8	128,939	2.1	7,505	.5	3,377
TOTAL HARDWOOD.....	1,104,442	14.8	940,302	15.5	164,140	11.8	73,863
TOTAL ALL SPECIES.....	7,462,990	100.0	6,069,497	100.0	1,393,493	100.0	627,072

†Saw timber figures were obtained by converting the cubic foot volume of the size class, 10" D.B.H. and over, to board feet on the assumption that one cubic foot is equal to 4.5 board feet.

*One cunit equals 100 cubic feet of wood: one cord equals 85 cubic feet of wood.



The Pas Lumber Company, saw mill, log-boom, and lumber yard.

forest. This area is on the Flin Flon branch of the Canadian National Railways, completed in 1929, and also on No. 10 Highway extended from The Pas to Cranberry Portage in 1948. At the present time a road is being constructed from No. 10 Highway to the important Snow Lake mining area and this will further stimulate general development.

Soil surveys have covered only a small proportion of the Forest Section but indications are that there is little soil which can be developed for agricultural purposes without the extensive aid of such measures as the addition of artificial fertilizers, drainage, or dyking. On the other hand, the moderately drained areas support very fine timber crops where the natural succession has not been interrupted too frequently by fire. There are some deep till soils with excellent forest growth, and some of the soils laid down by sedimentation in former lakes, or by the flooding of former or existing rivers, are probably the most fertile of all the soils in the Forest Section.

Forest Administration and Fire Protection

Previous to 1912, the area covered by this report, as well as adjoining areas to the north, east, and south, was part of the Keewatin District of the Northwest Territories. Although the boundary of the province of Manitoba was extended northward

to 60 degrees north latitude in that year, the forest resources along with other natural resources continued to be administered by the Federal Department of the Interior until 1930 when the Province became responsible.

Under the regime of the Department of the Interior, the Forestry Branch handled only fire protection, while the Timber and Grazing Branch administered the disposal of timber. A number of licences were granted in 1903 and 1904, giving the right to cut saw-timber on timber berths, each covering a maximum area of 50 square miles. These berths were located on lakes and rivers, and in view of the possible early construction of the Hudson Bay Railway, there seemed to be a good prospect of them becoming accessible. Most of the area held under these licences was later surrendered without any cutting having taken place, the main reason for their surrender being the failure of development of means of transportation. The only timber berths still held under licence are located at Cormorant and Goose Lakes in areas accessible by railway or highway, and the total area so held is 29 square miles.

A reconnaissance survey of timber conditions along the proposed route of the Hudson Bay Railway was carried out in 1910. Just before the transfer of the natural resources to the province, the

Table 7

*Cubic Foot Volume per Acre—Softwood and Hardwood by Age Classes and Cover Types—
Lowlands North Forest Section*

AGE CLASS <i>years</i>	VOLUMES IN CUBIC FEET PER ACRE BY COVER TYPES														
	S			M			N			H			Total		
	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total	Soft-wood	Hard-wood	Total
0 - 20.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21 - 40.....	378	74	452	399	91	490	345	252	597	133	304	437	360	103	463
41 - 60.....	536	57	593	562	111	673	316	235	551	197	433	630	522	82	604
61 - 80.....	726	66	792	712	145	857	425	305	730	164	401	565	685	113	798
81 - 100.....	1,095	81	1,176	1,068	228	1,296	591	470	1,061	254	629	883	1,023	167	1,190
100 - over.....	1,634	110	1,744	1,262	234	1,496	755	518	1,273	.....	.....	.....	1,444	185	1,629
MERCHANTABLE.....	665	68	733	753	155	908	452	339	791	164	380	544	651	113	764
PRODUCTIVE FOREST.....	298	31	329	238	49	287	452	339	791	78	180	258	231	49	330

COMPARISON OF SOFTWOOD TO HARDWOOD VOLUME BY AGE CLASSES

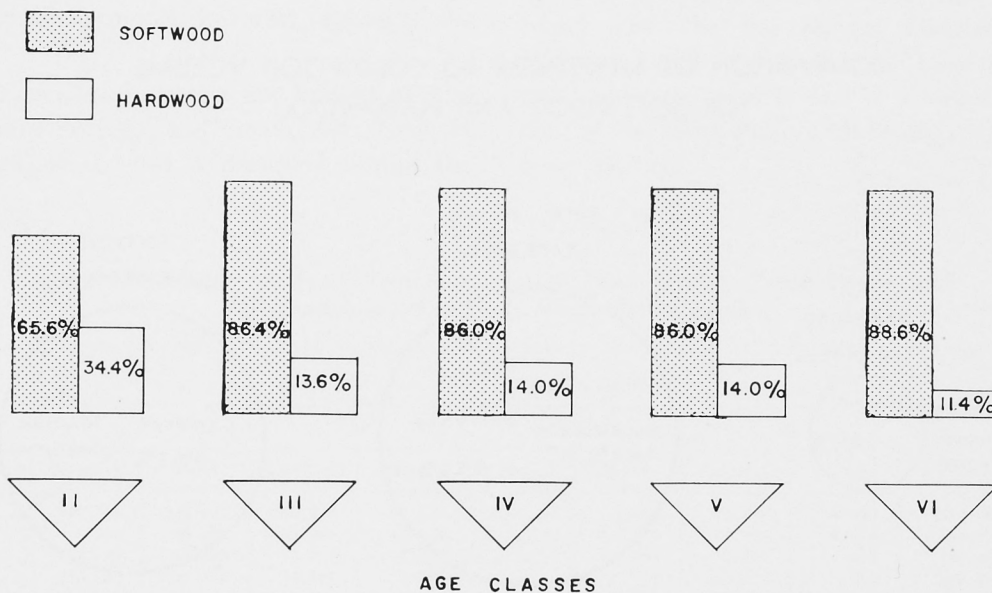


Figure 6.



Aerial view of The Pas marshes, and the Saskatchewan River, east of the Pas.

Federal Forest Service made a fairly detailed stock taking survey of the area east of the Hudson Bay Railway, the report on which was entitled "Sas-

katchewan River Survey." This survey involved extensive field work on the ground and the use of oblique aerial photography.

Before 1930, fire-ranging in the north was the responsibility of one permanent staff Chief Fire Ranger at The Pas and another at Norway House. In each of these two fire-ranging districts, a staff of seasonal fire rangers was employed for the summer months. In later years of the Dominion regime, fire detection and suppression for this portion of the north country was handled in co-operation with the Royal Canadian Air Force from a base at Cormorant Lake.

After the transfer of the natural resources in 1930, a considerable change was made in forestry organization. The administration of the timber resources as well as fire protection was made a Forest Service responsibility. The Northern Forest District was established with headquarters at The Pas, and a permanent staff was gradually built up to handle both fire protection and timber administration. The Manitoba Government Air Service was

COMPARISON OF SAWTIMBER TO CORDWOOD VOLUME FOR SOFTWOOD AND HARDWOOD

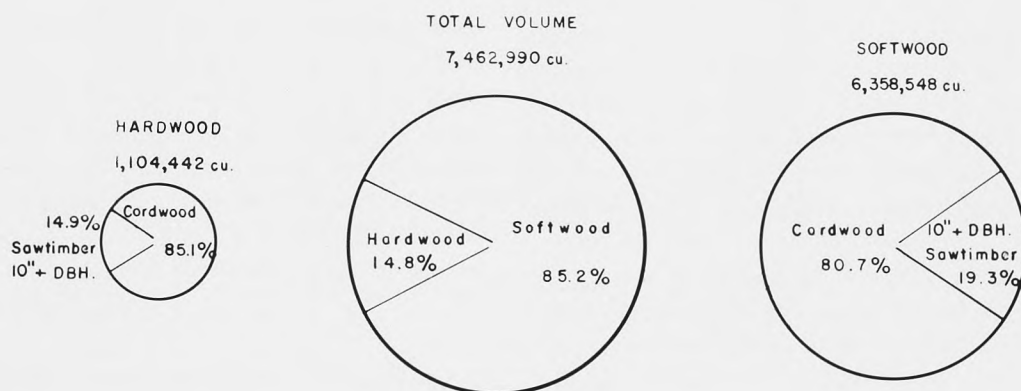


Figure 7.

Table 8
Area Classification by Working Circles—Lowlands North Forest Section

WORKING CIRCLE	LAND CLASSES IN ACRES					
	Productive Forest		Potentially Productive	Non-Productive Forest	Permanently Non-Forested Land	Total Land
	Unmerchantable	Merchantable				
Cedar-William.....	513,809	283,941	38,692	211,563	167,906	1,215,911
Moose Lake.....	186,315	180,881	.....	40,532	66,710	474,438
Hargrave.....	181,426	72,966	.....	341,808	357,678	953,878
Westray.....	146,604	22,145	228	263,627	142,329	574,933
The Pas.....	123,643	35,975	3,415	93,947	759,629	1,016,609
Cormorant.....	100,735	240,454	20,507	259,712	293,006	914,414
Cranberry.....	34,033	140,363	3,390	57,283	84,489	319,558
TOTAL.....	1,286,565	976,725	66,232	1,268,472	1,871,747	5,469,741

established in 1932, and since that time flying bases have been maintained, first, at Cormorant Lake, and later at Grace Lake, near The Pas. Aircraft are equipped with pontoons for water landing in the summer and with skis for landing on frozen lakes in the winter.

There are now nine steel lookout towers located within the Forest Section. These, together with several towers outside the boundaries serve for the detection and location of fires, but the system requires intensification to attain a standard of detection equal to that provided in forest regions to the south.

Forest rangers headquarters are located at The Pas, Cranberry Portage, and Snow Lake. Each of the nine lookout stations is occupied during the

summer months by a member of the seasonal field staff. The staff of the Northern Forest District office at The Pas consists of a District Forester, Forest Engineer, Chief Forest Ranger, Forest Ranger, Engineering Aid, and clerical staff.

The Lowlands North Forest Section as stated above, under "Location and Area" has been divided for inventory purposes into seven working circles; Cedar-William, Moose Lake, Westray, The Pas, Cormorant, Hargrave, and Cranberry. For administrative purposes, the first five have been combined into The Pas Ranger District. Hargrave Working Circle is part of Snow Lake Ranger District, and Cranberry is part of a larger ranger district of the same name with headquarters at Cranberry Portage.

Table 9
Area Classification of Productive Forest by Working Circles, Cover Types, and Merchantability—Lowlands North Forest Section

WORKING CIRCLE	AREA IN ACRES									
	S		M		N		H		Total	
	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.	Unmerch.	Merch.
Cedar-William.....	360,765	247,137	149,798	25,959	.....	6,612	3,246	4,233	513,809	283,941
Moose Lake.....	66,464	120,033	106,975	48,614	.....	7,179	12,876	5,055	186,315	180,881
Hargrave.....	122,790	62,278	55,817	9,249	.....	989	2,819	450	181,426	72,966
Westray.....	140,447	19,193	6,157	2,736	.....	72	.....	144	146,604	22,145
The Pas.....	62,539	18,788	53,902	5,186	.....	7,117	7,202	4,884	123,643	35,975
Cormorant.....	70,396	152,371	24,581	57,859	.....	19,265	5,758	10,959	100,735	240,454
Cranberry.....	27,808	74,610	3,197	35,587	.....	24,461	3,028	5,705	34,033	140,363
SUBTOTAL.....	851,209	694,410	400,427	185,190	.....	65,695	34,929	31,430	1,286,565	976,725
TOTAL.....	1,545,619		585,617		65,695		66,359		2,263,290	

MERCHANTABLE SOFTWOOD VOLUME
BY AGE CLASSES
MERCHANTABLE VOLUME 6,358,548 CU.

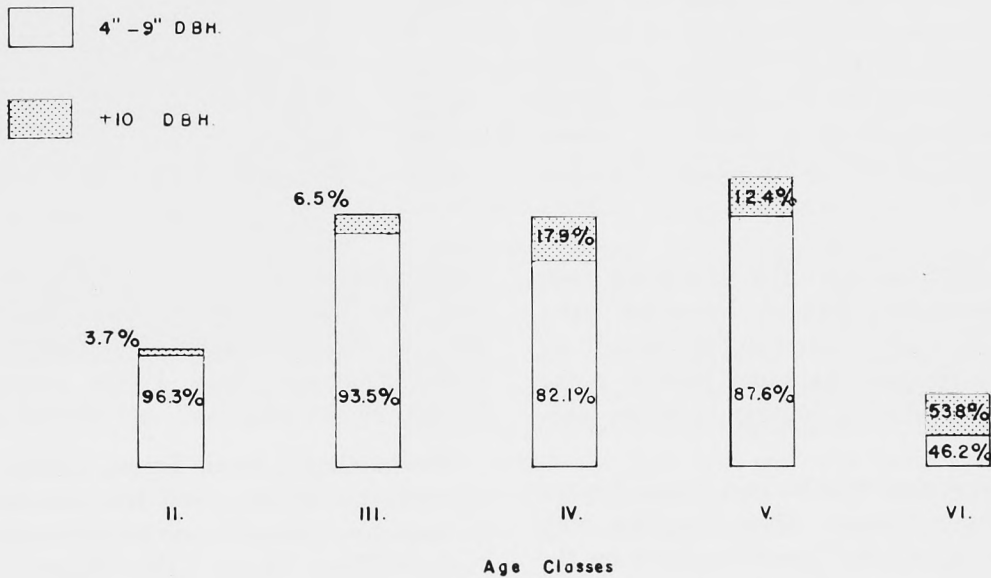


Figure 8.



Summer resort scene at Atikameg (Clearwater) Lake.

Area Classification and Forest Composition

Table 1 shows that 41.4 per cent of the total land area of the Lowlands North Forest Section has been classified as productive forest land and 1.2 per cent as potentially productive, or a total of 42.6 per cent capable of producing timber crops. A word of explanation is required here re this apparently, relatively low percentage of productive land. When the forest inventory was planned, a decision had to be made as to whether The Pas marshes should be included or excluded from the forest zone. It might well be said that the future of this area lay in agriculture or muskrat ranching rather than forestry. On account of being surrounded by a forest area, and because the marshes included small areas of merchantable timber and young growth, it was decided to include the whole in the inventoried area. Ex-

Table 10*Softwood and Hardwood Volume by Size Classes and Working Circles—
Lowlands North Forest Section*

WORKING CIRCLE	VOLUME IN CUNITS (100 cu. ft. Units)					
	Softwood		Hardwood		Total	
	4'' - 9'' D.B.H.	10'' + D.B.H.	4'' - 9'' D.B.H.	10'' + D.B.H.	4'' - 9'' D.B.H.	10'' + D.B.H.
Cedar-William.....	1,340,368	199,372	202,644	18,138	1,543,012	217,510
Moose Lake.....	1,077,023	307,588	190,239	33,007	1,267,262	340,595
Hargrave.....	318,385	23,559	33,384	2,319	351,769	25,878
Westray.....	90,129	9,540	11,901	592	102,030	10,132
The Pas.....	161,892	75,679	44,425	9,051	206,317	84,730
Cormorant.....	1,320,839	352,745	247,620	46,360	1,568,459	399,105
Cranberry.....	820,559	260,870	210,089	54,673	1,030,648	315,543
TOTAL.....	5,129,195	1,229,353	940,302	164,140	6,069,497	1,393,493
PER CENT.....	80.7	19.3	85.1	14.9	81.3	18.7

cluding The Pas Working Circle which coincides approximately with The Pas marshes, see Map 2, the productive and potentially productive forest area in the Forest Section is raised to 48.6 per cent.

Table 2 shows the relatively high percentage of softwood. The combined "S" and "M" cover types (50-100 per cent softwood) make up 94.2 per cent of the productive forest area, leaving only 5.8 per cent for the combined "N" and "H" cover types (0-50 per cent softwood)—see definition of cover types in the Appendix.

Considering volume by species—jack pine leads, followed by white spruce, black spruce, and aspen, in that order.

Reference is made to Tables 1 to 7 which give area and volume data for the whole forest section, and to Tables 8 to 12 giving similar information by working circles.

Forest Inventory

Ground control was available in the form of base lines which cross the whole area, in an east and west direction, at intervals of 24 miles. In addition, the Saskatchewan boundary had been surveyed as well as subdivisions along the Canadian Northern Railway south of The Pas, and along the Hudson Bay Railway to the north.


Coverage by aerial photographs was available for most of the area in advance of the initiation of the


inventory. Most of the western part of the Forest Section had been photographed vertically by the R.C.A.F. at a scale of 1:31,680 in 1947, while the eastern part was done in 1950 at 1:36,000. A small portion in the northwest was photographed by Spartan Air Services at a scale of 1:31,680 in 1952 as part of a provincial contract covering a large area extending further to the north. In all cases, the final forest maps were produced at a scale of 1:31,680, i.e., at 4 inches per mile.

Base mapping was done mainly by the provincial Surveys Branch using the slotted template method, although part of the area was done in the Northern Forest District office at The Pas with the aid of advance information sheets supplied from Ottawa.

A six-man field party cruised in the Simonhouse, Yawningstone, Cormorant area in 1950. This work was done in advance of the adoption of the final inventory system, but data from this survey was combined with that of the 1951 field survey to supply the information for the type aggregate volume tables for the whole Forest Section. The 1951 field survey party consisted of seven men and covered an area around Rocky, Goose, Athapapuskow, Cormorant, and Atikameg Lakes. During the two years, a total of 2,450 one-fifth acre plots were tallied as representative of the various cover-type, site, height, and density classes. The eastern part of the Forest Section was covered by a two-man type checking party in 1952.

MERCHANTABLE HARDWOOD VOLUME
 BY AGE CLASSES
 MERCHANTABLE VOLUME 1,104,442 CU.

 4"-9" DBH.

 + 10" DBH.

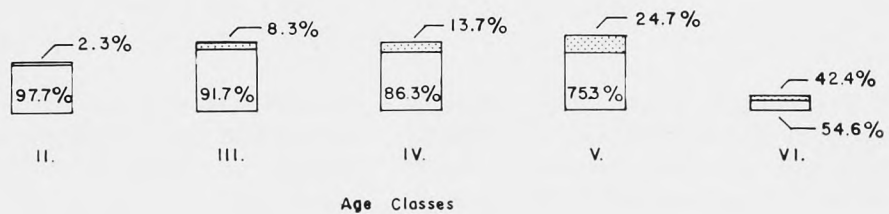


Figure 9.



Forest survey party at Rocky Lake.

Table 11*Softwood and Hardwood Volume by Working Circles—
Lowlands North Forest Section*

WORKING CIRCLE	*VOLUME IN 100 CUBIC FOOT UNITS (Cunits)		
	Softwood	Hardwood	Total
Cedar-William.....	1,539,740	220,782	1,760,522
Moose Lake.....	1,384,611	223,246	1,607,857
Hargrave.....	341,944	35,703	377,647
Westray.....	99,669	12,493	112,162
The Pas.....	237,571	53,476	291,047
Cormorant.....	1,673,584	293,980	1,967,564
Cranberry.....	1,081,429	264,762	1,346,191
TOTAL.....	6,358,548	1,104,442	7,462,990
PER CENT.....	85.2%	14.8%	100.0%

*Net roundwood volume: stump height 1', top diameter 3".

Photo interpretation and forest mapping was done, partly in the district office at The Pas, and partly in head office at Winnipeg. The tree volume tables for the separate species were prepared at The Pas, while work on general stand volume tables, species and size class distribution leading up to the preparation of type aggregate volume tables was divided between The Pas and Winnipeg. See Table 13 and Appendix.

Much of the compilation and mapping was completed by 1953, but due to pressure of work in other forest sections the final estimate was not completed until May, 1954.

Forest Utilization and Potential Yield

Records of the annual cut on Crown lands in the Northern Forest District are available for the period 1930 to the present time, but the figures are not separated by Forest Inventory sections. As a matter of fact, the Northern Forest District, i.e., the administrative district so called includes the Lowlands North, Northern Mining, and the northern two-thirds of the Nelson River Forest Section, as well as nearly all the Inaccessible Forest Zone. However, it has been possible to work out the portion of the cut which is applicable to the Forest Section under consideration in this report covering the last five years. The average annual cut of the main products — lumber, pulpwood, and railway ties—in the Lowlands North Forest Section for the

years 1954-55 to 1958-59, inclusive, is approximately as follows:

Lumber	1,112,000 ft. b.m.
Pulpwood	7,035 cords
Railway ties	20,962 pieces

The lumber cut is mainly white spruce with minor amounts of jack pine. The pulpwood cut during the last five years has been all black spruce, although considerable jack pine was cut in previous years before increases in railway freight rates made the cutting of this species unprofitable. The railway tie production is entirely from jack pine. Other forest products of lesser importance are fence posts, poles, piling, building logs, mining timber, boxwood, and fuelwood.

Converting the cut of lumber, pulpwood, railway ties, and minor forest products into a common unit of cubic measure, it is found that the average annual depletion of green softwood from cutting is approximately 11,180 cunits, or 13,153 cords. The cut of hardwood is insignificant. At the present time, there are about 16 small portable sawmills operating in the Forest Section producing lumber and railway ties. A modern framing mill is producing jack pine cribbing at Atikameg Lake for shipment to Thompson where it is used in connection with the mining operations of the International Nickel Company. Fish boxes are manufactured at The Pas, Cranberry Portage, and Grand Rapids, while at the former place a few small industries produce core boxes, boats, canoes, toboggans, cabinets, and furniture.

Table 12*Softwood and Hardwood Volume per Acre
Merchantable Area by Working Circles—
Lowlands North Forest Section*

WORKING CIRCLE	VOLUME PER ACRE IN CUBIC FEET		
	Softwood	Hardwood	Total
Cedar-William.....	542	78	620
Moose Lake.....	766	123	889
Hargrave.....	469	49	518
Westray.....	450	56	506
Che Pas.....	660	149	809
Tormorant.....	696	122	818
Cranberry.....	770	189	959
AVERAGE.....	652	112	764

CROWN MERCHANTABLE VOLUME BY SPECIES

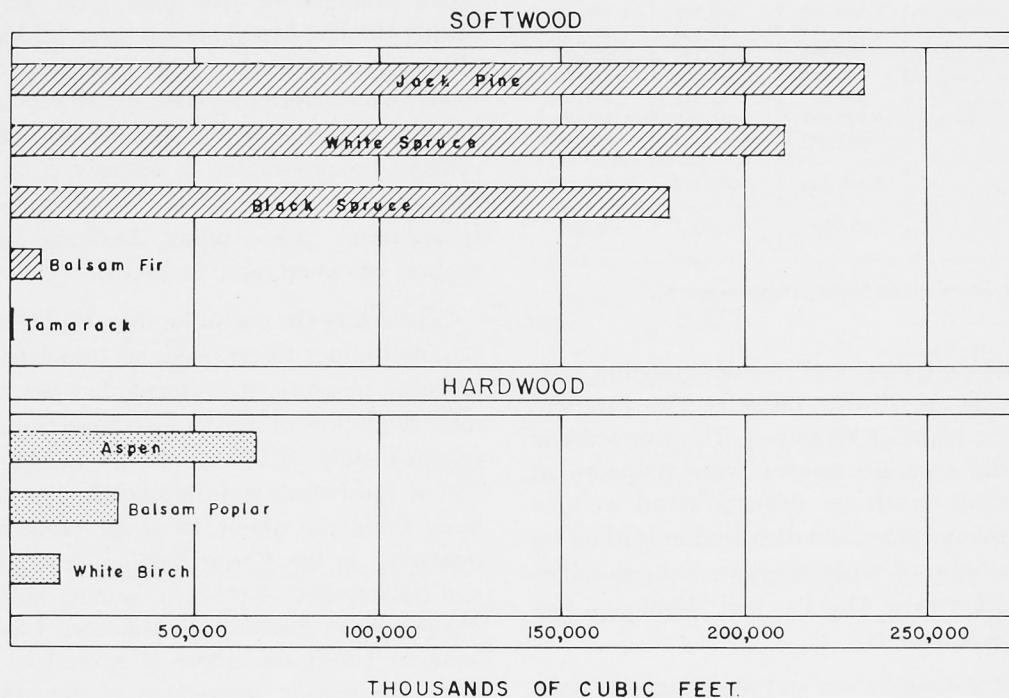


Figure 10.

Table 13
General Stand Volume Table—Lowlands North Forest Section
(Data from Final Set of Curves)

HEIGHT CLASS	DENSITY CLASSES (In square feet of basal area per acre at breast height)									
	A 0' - 20'	B 20' - 40'	C 40' - 60'	D 60' - 80'	E 80' - 100'	F 100' - 120'	G 120' - 140'	H 140' - 160'	I 160' - 180'	J 180' - 200'
	VOLUME IN CUNITS PER ACRE (100 cu. ft.)									
4 (30' - 40').....	1.25	3.85	6.50	9.05	11.75	14.35	.....	.....	.....	.....
5 (40' - 50').....	1.65	4.75	8.00	11.15	14.40	17.60	20.85	.....	.....	.....
6 (50' - 60').....	1.90	5.70	9.55	13.25	17.15	20.90	24.70	28.40	.....	.....
7 (60' - 70').....	.....	6.65	11.10	15.35	19.75	24.20	28.50	32.80	37.25	41.75
8 (70' - 80').....	.....	7.65	12.65	17.40	22.50	27.50	32.35	37.30	42.35	47.34
9 (80' - 90').....	.....	.....	.....	19.50	25.10	30.70	36.20	41.70	47.20	53.15

Volumes refer to Gross Round Wood Volume to 3" top and 12" stump.
Based on 2.450 one-fifth acre plots measured in the field.



Exhibit by Department of Mines and Natural Resources at The Pas.

The allowable annual cut on a sustained yield basis can be calculated approximately for softwood and hardwood for the whole Forest Section, using the method described under "Allowable Cut" in the Appendix to this report. The result of the calculation is as follows:

Allowable annual cut of	
softwood	127,171 cunits or 149,613 cords
Allowable annual cut of	
hardwood	33,133 cunits or 38,930 cords
Allowable annual cut	
all species	160,304 cunits or 188,593 cords

This estimate is considered to be on the conservative side, and it can also be predicted that improved fire protection and silviculture will considerably increase the sustainable annual yield. Satisfactory natural regeneration appears to be taking place in burned-over and cut-over areas, and

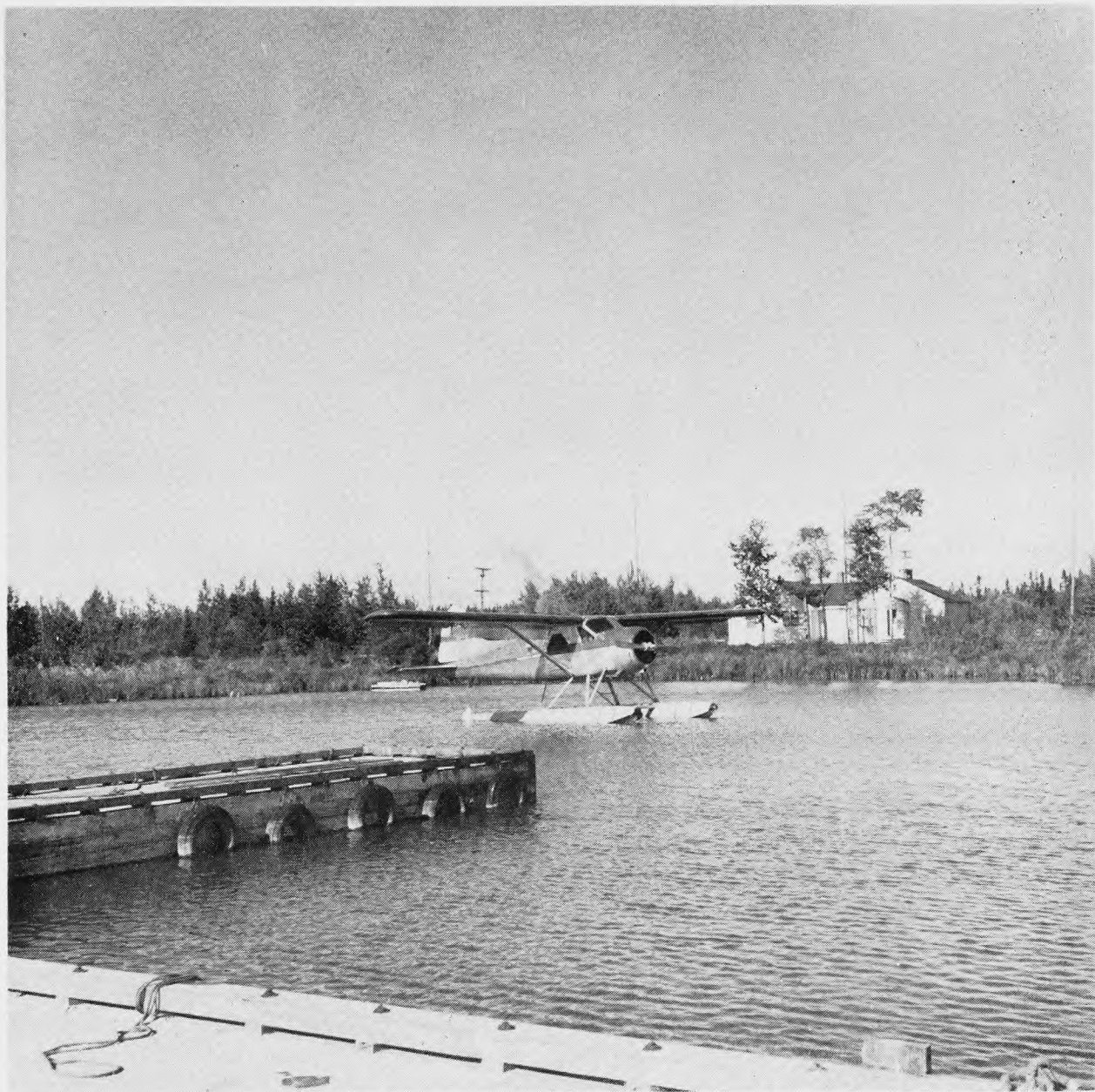
there is a tendency for jack pine to be succeeded by the more valuable spruce as the stands grow older.

Comparing the actual with the permissible annual cut, it is apparent that forest production could be greatly expanded in this Forest Section. It should be noted, however, that at the present time nothing is being cut in the southeastern part of the Forest Section except a small amount of jack pine boxwood for a local fish box mill at Grand Rapids.

Plans have recently been announced re the construction of a highway north from Gypsumville to Grand Rapids, and from there northward to the Hudson Bay Railway, and this highway will open up new forest areas. Nevertheless, due to distance from larger markets and the present high railway freight rates, little expansion of forest production can be expected to take place until one or more major forest industries are established in the district. Such an industry, or industries, might take

the form of a pulp and paper mill, or an integrated type of industry, which could use timber of saw-timber size and also smaller material. Ample hydro-electric power can readily be made available from the Kelsey generating station on the Nelson River, and it is probable that in the near future power will also be developed at Grand Rapids on the Sas-

katchewan River. This combination of timber resources and hydro-electric power makes it seem likely that large scale forest industry will be attracted to Northern Manitoba. Studies made to date indicate that suitable sites for such industries within the Lowlands North Forest Section are available at The Pas or at Grand Rapids.



Manitoba Government Air Service Dock at Grace Lake.

Appendix

SURVEY METHODS

Ground Control

Ground control for aerial photographs was obtained mainly from base lines, township outlines, and subdivision surveys established either before or during the progress of the forest inventory. The distance between control lines varied from one mile in the southern part to as much as 72 miles in the north. In certain cases it was necessary to make traverses of winter roads, lakes, and rivers in order to fill in blanks where cadastral surveys were lacking.

Air Photography

The photographs on which the inventory was based were summer verticals varying in scale from 1:15,840 to 1:36,000, taken mainly in the period 1946 to 1953, inclusive.

Base Mapping

The slotted template lay-down method of base mapping was used. A base map consisted simply of a large sheet of paper showing township grids on which were located the primary and secondary control points of the photographs covering the area.

Field Surveys

The type classification used in this survey was an adaptation of the system developed by S. T. B. Losee of the Abitibi Power and Paper Company. Types were differentiated by species, composition, height, density, site, and subtype, the following breakdown being employed:

(a) *Cover-type*

- S : 75-100% conifers by basal area
- M : 50- 75% conifers by basal area
- N : 25- 50% conifers by basal area
- H : 0- 25% conifers by basal area

(b) *Height Class*

- 1 : Average height of main stand 0-10 feet
- 2 : Average height of main stand 10-20 feet
- 3 : Average height of main stand 20-30 feet
- Etc.

(c) *Density Class*

- A : 0-20 square feet per acre basal area
- B : 20-40 square feet per acre basal area
- C : 40-60 square feet per acre basal area
- Etc.

(d) *Site*

- V₁ : Jack pine ridge top
- V₂ : Black spruce ridge top
- W : Hardwood upper slope
- X₁ : Black spruce lower slope
- X₂ : Mixed lower slope
- Y₁ : Jack pine flat
- Y₂ : Poplar flat
- Z₁ : Wet flat (black spruce)
- Z₂ : Cedar flat

(e) *Sub-type*

- 1 : 0- 12% of conifer basal area jack pine
- 2 : 13- 37% of conifer basal area jack pine
- 3 : 38- 62% of conifer basal area jack pine
- 4 : 63- 87% of conifer basal area jack pine
- 5 : 88-100% of conifer basal area jack pine

The above subtypes were used in conjunction with all four cover-type symbols—S, M, N, and H, depending on the percentage of jack pine in the coniferous portion of the stand. Additionally, in the S cover-type there might be tamarack subtypes. These were shown by the suffixes L1, L2, L3, L4, and L5, denoting the same percentage of tamarack volume as the first suffixes did for jack pine.

The term type-aggregate has been used as referring to all types in a Forest Section which have common characteristics as to cover-type, height, density, site, and subtype. For example, the symbol "S7EX₁-1" denotes a type with 75-100 per cent of the basal area in coniferous species, average height 60-70 feet, basal area per acre 80 to 100 square feet, growing on a lower slope site and mainly black spruce, with a jack pine composition less than 12 per cent of the coniferous basal area.

Sampling was distributed as widely as possible over the total inventory area, the twin objectives being to obtain sufficient data for local tree and type-aggregate volume tables, and to familiarize the photo-interpreters with the varying stand conditions to be found in different localities.

Sampling was by means of one-fifth-acre plots (one-quarter chain wide by eight chains long) established at fixed intervals along cruise lines selected by the party chief. In order to obtain a well-distributed sample of all type-aggregates, the party chiefs were instructed to sample as many type

aggregates as possible from each camp site, and not to take too many plots in one particular type in the same general area. Information recorded on each plot included the cover-type, site class, tally by species of all trees over 3.5 inches D.B.H., and four height-age measurements of representative trees. Notes were also made on the topography, soil and young growth, minor vegetation, and the general condition of the stand. Sufficient form class measurements were made to determine for each species the relationship between form class, diameter, height, and site. Special notes were made on young growth areas.

Forest Maps

The location of all boundary lines between the various forest types was determined almost entirely from examination of the photographs with the aid of a stereoscope.

After photo interpretation, both forestry and planimetric information was transferred from the photos to the base maps by means of either a Sketchmaster or Seelyscope. The areas of the various forest strata were determined either by dot count or by measurement with a planimeter.

Each finished forestry map covers one township at the 1:15,840 scale, or four townships at smaller scales. Ozalid prints of the completed maps were prepared for distribution to district personnel and one master copy of each map was hand-colored for filing, using the standard colors recommended by the Federal Forestry Branch.

Interpretation and Compilation

After field sampling in a given area was completed, the final photo interpretation was made. Since it is on the quality of this work that the accuracy of the inventory largely depends, an effort was made to have the man most familiar with a particular area make the final photo interpretation for that area. Much of the final interpretation was done in the field by the party chiefs and cruisers at a time when stand conditions as they appeared on both the ground and the photos could readily be compared.

The first step in compilation was the transfer of field data to two sets of summary sheets. The height-age and form class data obtained from measurements of sample trees was used to prepare local tree volume tables, while the data on the tally sheets was the basis for the type-aggregate volume tables.

For each Forest Section, separate tree volume tables were prepared for each species, site, and height class. The Dominion Form Class Volume Tables were used in conjunction with the height-age and form class data to prepare the local volume tables. The standard system of harmonizing curves was used.

The next step was the preparation of a general stand volume table showing gross volume per acre, all species combined. Field plot data was segregated by height and density classes regardless of site and cover-type. Using the method of least squares and linear regression a series of straight lines was drawn and later harmonized by the Dwight method. Values read from these lines formed a general stand volume table showing average volume in cunits per acre by height and density classes for the whole Forest Section. See Table No. 13.

The next step was the determination of the proportion of each species in each type-aggregate. This was done by a special method of percentages and curves. Similar methods were used to determine the proportion of the two size classes, four to nine inches D.B.H., and ten inches plus. The percentages as arrived at by harmonizing the curves for each height class were applied to the previously calculated general stand volume table, and the results were tabulated as the final type-aggregate volume table.

Up to this point in compilation, stand age was not considered. However, the large number of height-age measurements obtained in the field made it possible to establish by means of a series of curves, the relationship between site, height, and age for each of the major species on each site. Age classes could then be assigned to all type-aggregates. Thus, when the final volume summaries were made, they were subdivided by cover-type and age class only; height, site, and density being omitted.

Gross volumes of each individual type were first tabulated in cubic feet by numbered types and later compiled in township units by species, cover-type, age class, size class, and land tenure.

In order to express the net rather than the gross volume, a cull factor was established for each species in each Forest Section. This factor was based on a general knowledge of the various species, and notes made by the cruisers regarding defects observed on the sample plots. The cull factor was applied to the gross figures for the Work-

ing Circle and not to the smaller units of type and township. See Table 14.

Table 14

Cull Factor by Species—Lowlands North Forest Section

<i>Species</i>	<i>Cull per cent</i>
White spruce.....	5
Black spruce.....	5
Balsam fir.....	25
Jack pine.....	25
Tamarack.....	10
Aspen.....	50
Balsam poplar.....	50
White birch.....	40

Reports

Fifty-five inventory summaries were compiled for Working Circles or Ranger Districts, each of these units averaging about 1,000 square miles in area. Each summary contains a breakdown of the area and net volume by cover-types and age classes. Subtotals are included for the Crown and patented portions of each unit. Net volumes are expressed in both cunits (100 cu. ft. units) and M ft.b.m. for the ten inch plus diameter group, and in cunits alone for the four to nine inch D.B.H. group. These inventory summaries were totalled by Forest Sections, and a report is being published on the forest resources of each Forest Section.

ROTATION

The length of the rotation for the various species depends on the site, the product to be cut, and, to a lesser extent, the climatic region. Table 15 gives tentative figures for the productive forest area of Manitoba. A range of rotation age is given depending mainly on whether the stand is to be cut for pulpwood or saw-timber.

Table 15

Rotation by Species

<i>Species</i>	<i>years</i>
White spruce.....	80 - 120
Black spruce.....	80 - 140
Balsam fir.....	60 - 80
Jack pine.....	60 - 90
Tamarack.....	70 - 100
Cedar.....	100 - 200
Aspen poplar.....	50 - 70
Balsam poplar.....	50 - 70
White birch.....	60 - 80

ALLOWABLE CUT

A determination of the allowable annual depletion by cutting, fire, etc., is necessary in order that the forest may be kept on a sustained yield basis. The compiled inventory data presents volume by cover-type, age class, and species while area is presented by age class and cover-type only. The method of calculation most suitable to the available data is by a volumetric formula.

The simplest formula for finding the annual yield, commonly known as the Von Mantel formula, is as follows:

$$\text{Annual Yield} = \frac{\text{Growing Stock}}{\text{Half the number of years in rotation}}$$

For general inventory purposes this formula has been used as the basis for calculation of the allowable cut by Working Circles, each species being calculated separately according to its average rotation age. A deduction of 20 per cent has been made to allow for contingencies such as loss from fire, windfall, insects, and disease.

In those areas which have established Working Plans such as the Southeastern Forest Section, the Duck Mountain Forest Reserve, Pulpwood Berth No. 1, and certain portions of the Lowlands South Forest Section, various alternative methods have been used in arriving at the Allowable Cut. It is usual in these cases to secure a more accurate estimate of the Allowable Cut by methods which take into account any unevenness in age class distribution.

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Common and Botanical Names of Tree Species Included in Timber Estimates

CONIFERS

White Spruce —	<i>Picea glauca</i> (Moench) Voss
Black Spruce —	<i>Picea mariana</i> (Mill) BSP.
Balsam fir —	<i>Abies balsamea</i> (L.) Mill
Jack pine —	<i>Pinus banksiana</i> Lamb.
Tamarack —	<i>Larix laricina</i> (Du Roi) K. Koch
Cedar —	<i>Thuja occidentalis</i> L.

HARDWOODS

Aspen poplar —	<i>Populus tremuloides</i> Michx
Balsam poplar —	<i>Populus balsamifera</i> L.
White birch —	<i>Betula papyrifera</i> Marsh.

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